ROAD ASSET MANAGEMENT SYSTEM FOR BRUNEI DARUSSALAM

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ABSTRACT

The purpose is to propose a "best-practice" approach to improve the current management of road assets operation and maintenance in Brunei Darussalam. It represents the much-needed change in current practice by the Department of Roads in managing its overall road infrastructure network.

The Road Asset Management System model for Brunei Darussalam indicates the appropriate framework ideally suited for the country. This proposal is based on the studies and research of other Asset Management systems being developed and practised in particular to the Australian and New Zealand, UK and US experiences. This will coincide with the basic fundamentals of Total Asset Management approach, and be the basis of an improvement for the current practice of road management and maintenance within the responsible Department. The System will make full use of available resources, existing management methods, supporting tools, techniques and processes, and re-organise them to suit the Asset Management requirements. New processes and tools are also needed to reinforce the system. This will assist top management in presenting information on project needs, status and progresses to stakeholders, customers and above all to the budget committee (fund provider).

INTRODUCTION

Having an efficient and sound transport infrastructure network benefits the socio-economic well-being of a country. It contributes to the overall development of a nation by opening up areas of social, political, economic and security values. Sustained and adequate investments in transportation are relatively essential to achieving the nation's social, economic and security goals (McElroy 1999).

In achieving this, governments invest heavily towards the planning and creation of integrated transport networks. More have been, and is being spent on roads and related structures, which play the major role in any infrastructure network, and is by far the most essential and widely used form of transportation. This is more evident where the need to achieve developed status encourages them to invest in the construction of new road linkages and upgrading of existing assets. Such improvement strategy is perceived to be the key development factor to the standards and socio-economic enhancements of a developing country, striving towards their ambition of becoming a developed nation.

For developed and advanced countries like the United States, United Kingdom, Europe, Japan and Australia, which had achieved the essential infrastructure networks, have diverted their attention towards their sustainability and performance, through its management, operation and maintenance requirements. The governments have long realised that their road infrastructure assets need to be sustained to satisfactory levels of quality, safety and durability, which are to the expectation and demand of the users.

Developing countries too followed suit, learning from lessons learnt and adopting the strategic sustainable development of their assets and changing mindset for thinking ahead, while still investing in major capital construction. It was important to realise the concept of managing assets and adopt the ideology to fit a nation's political, social, economical and environmental requirements.

Asset Management requires resources to be well-planned and enhanced, in terms of technical human support, to adequate and justifiable funding. Slowly but surely, the mindset of just "maintenance" transformed into the "management of assets", and became the accepted modern day culture and business of organisations responsible for their infrastructure assets. Various responsible organisations within the developing nations adopted similar patterns of asset management, learning from each other, and utilising resources and methods to fit their management style most comfortable to their own. Asset managers realised the need for effective tools and techniques to manage their vast assets and assist in the overall decision-making process (Vanier 2000).

Brunei Darussalam, being a small developing nation, too had realised the importance of asset management in its public infrastructure development. The current management practice within the responsible organisations are still traditional, but the accepted culture. There is the awareness and need for a similar change management to fulfill the requirements for the likes of the asset management approach. Certain aspects of the current management style have to be integrated and organised to meet the principle requirements for an asset management strategy. Resources and decision-making processes will deem benefit from such a change, which will eventually improve the management quality, hence "best-practice" to service delivery.

CURRENT ROAD MAINTENANCE PRACTICE IN BRUNEI DARUSSALAM

The Public Works Department (PWD) under the Ministry of Development (MOD) is the sole organisation responsible to construct and maintain the country's overall government-owned or gazetted public infrastructure developments. The overall national road assets comprises of about 2,570 lane km and around 690 structures (based on 2004 statistics). Due to the relatively small size and population of the country, the Government still finds it manageable to utilise its own resources towards the public road development and maintenance without the need for private initiatives.

Table 1 below indicates the four main categories of road network against the estimated road asset value priced at average market values (2004). This indicates the country's overall road network asset having a B$3 Billion balance sheet.

Estimated Road Asset Value (2004)			
Classification	**Length (km)**	**Av. Cost / km (B$)**	**Total Cost (B$)**
Primary Roads (highways)	555	2,200,000	1,221,000,000
Secondary Roads (main roads)	197	1,800,000	354,600,000
Distributor Roads	934	1,400,000	1,307,600,000
Local Access Roads	884	400,000	353,600,000
Total	**2,570**		**3,236,800,000**
Note: 1.00 GBP equivalent to about B$3.00			

Table 1: Estimated Road Asset Value (2004)

Table 2 below indicates the pavement surface types within each district, showing that the main bulk of roads are within the smallest but the most important district (Brunei/Muara). It also shows that there are no longer roads which are either sealed or earth. The future trend will have all roads either in concrete or asphalt finishes. This program is being implemented through upgrading works.

Surface Type vs District (2004)						
District	**Asphalt**	**Concrete**	**Sealed**	**Gravel**	**Earth**	**Total (km)**
Brunei/Muara	1177	128	0	182	0	**1487**
Tutong	251	30	0	190	0	**471**
Belait	378	21	0	43	0	**441**
Temburong	132	8	0	30	0	**171**
Total (km)	**1938**	**186**	**0**	**445**	**0**	**2570**

Table 2: Surface Type vs District (2004)

Table 3 below indicates the pavement surface types against the carriageway lengths (lane km) for an 11-year period from 1994 to 2004, which shows a steady annual increase.

Surface Type - Carriageway km (1994-2004)						
Year	**Asphalt**	**Concrete**	**Sealed**	**Gravel**	**Earth**	**Total (km)**
1994	1101	25	113	364	72	1675
1995	1114	30	114	376	70	1704
1996	1234	50	100	378	50	1812
1997	1317	50	100	315	40	1822
1998	1448	122	50	351	50	2021
1999	1586	132	-	452	50	2220
2000	1733	156	-	461	-	2350
2001	1780	162	-	439	-	2381
2002	1810	148	-	440	-	2398
2003	1851	151	-	455	-	2457
2004	1938	186	-	445	-	**2570**

Table 3: Surface Type–Carriageway km (1994-2004)

Table 4 below indicates the annual re-current maintenance fund from 1994 to 2004. When the statistics were based against the total annual road length in the asset inventory, the annual fund showed increase at par with the increasing annual road lengths. However, when compared with the maintenance cost per km length, it decreased over the years. This proves that increased annual budgets are still insufficient to cover the required maintenance costs.

Annual Maintenance Fund (1994-2004)			
Year	**Length (km)**	**Annual Fund (B$Mil)**	**Cost per km (B$)**
1994	1675	12.75	7,612
1995	1704	13.00	7,629
1996	1812	13.25	7,312
1997	1822	13.75	7,547
1998	2021	14.00	6,927
1999	2220	14.75	6,644
2000	2350	15.00	6,383
2001	2381	15.30	6,426
2002	2398	15.70	6,547
2003	2457	15.91	6,475
2004	2570	16.01	6,229

Table 4: Annual cost per km

There have always been concerns on miss-communications and miss-conceptions of factors relating to the segregation between road construction and maintenance. These include differences in standard achievements, technical superiority, different work cultures, managerial concepts and others. There is no collective thinking of looking at the road network as an “asset” from the perspective of its strategic “creation”, “operation and maintenance”, and subsequent “disposal”, as what Total Asset Management approach is all about.

The limited personnel to handle the enormous tasks of the overall maintenance of the entire national road network, poses challenges in almost every aspect of the working environment. Should we be looking at a more strategic approach of procurement methods and greater flexibility of outsourcing specific works? Is an Integrated Management approach the best practice considering the human resource issue? These will be researched and a solution be proposed to help alleviate the issue, i.e.; through Resource Management.

There is a lack in the use of available management systems like the Pavement and Bridge Management Systems, which should assist planners in the proper planning towards the application between works and required funds. The method of road observations and reliance on customers’ inputs (complaints and requests) are still the conventional way of proposing maintenance strategies. The need of better equipped system through the backup of data and information for work proposals should be in place, for verification, clarification and accountability.

The management style is still relatively traditional and conventional. Though there have been various improvements over the years, the culture of the current practice is still based on the mindset of “maintenance” rather than “management”. In slowly realising the benefits and need for a proper management system for road maintenance in the public sector organisation, various improvements and practices should be addressed. There is yet the need to emphasize on pro-active thinking rather that reactive management. Though the culture is slowly but surely changing, the management style has to be drastically re-organised to enforce an advanced form of Asset Management framework.

TOTAL ASSET MANAGEMENT (TAM) CONCEPT

The Australian government is the pioneer in the field of Asset Management, and they became the benchmark of other organisations worldwide. It developed advanced strategies in the concept and practice of Asset Management, and later developed the concept of **Total Asset Management (TAM)**. This concept is predominantly an overall look into the strategic approach and management of the economic whole life cycle of physical assets to best supporting the organisation’s defined service delivery. TAM requires a detailed outline of an Asset Management strategy from the perspective of three primary approaches for the submission of funds. This strategy proposes how an asset is to be strategically **“acquired”** (created), **“maintained”** or **“disposed”** of.

Reference is made to the Australian government’s guideline into Total Asset Management strategic planning for its asset funding which was prepared by the Treasury Department. The latest revision (June 2006) for the TAM Guideline of New South Wales (NSW) Treasury which now supersedes the previous September 2004 version, requires agencies to prepare their Asset Management Strategic Plan according to the following alignment (Figure 1).

Figure 1: Total Asset Management Guideline Process

The Australians had developed the most advanced form of Asset Management concept and principles through its Total Asset Management (TAM) approach, largely due to their earlier initiatives, knowledge and experience. It presents how the Government and its supporting agencies strive to sustain not only its infrastructure development, but its overall responsible assets of the country. As long as an agency is managing any form of assets, it is required to undergo the process of its management through the TAM process.

This indicates the Government’s position set to unify its overall asset management quality through its own set of standards, specific aims and objectives, more relevantly, through a holistic approach. This achievement sets a benchmark for other organisations worldwide to look into the TAM approach and apply its principles accordingly to within their own environment.

HIGHWAY ASSET MANAGEMENT IN AUSTRALIA & NEW ZEALAND

Australia being the pioneer in the asset management concept has become the accepted benchmark as the main source of reference for studies, research and implementation programs. With New Zealand as the immediate neighbour country, both have combined efforts in the field of asset management in the road sector.

Based on Austroads (Road facts 2005), Australia is not only a country but a single continent with 3 different time zones stretching from the Indian Ocean in the western tip to the Pacific in the east. Its land mass equals that of the continental United States, and 32 times the United Kingdom. There are about 20 million Australians thus less than three people for every square kilometer. It is also one of the most urbanised societies in the world where 85% of the population resides in urban areas. It maintains one of the most extensive road networks worldwide with a staggering 800,000km of public roads and over 37,000 bridges. With varying climatic conditions, the roads are subjected to varying types and rates of surface deterioration. Government spending for its road network maintenance program is around A$30 million every working day.

New Zealand, divided into 2 major islands (north and south), lies 1,600 km east of Australia and is 28 times smaller in land mass. It has around 4.1 million inhabitants where 85% live in urban areas. The road network comprises 92,500 km of roads and 17,300 bridges. State highways and local roads serve the large cities and smaller urban areas. Transit New Zealand strategically manages the state highways of an asset value of NZ$12.5 billion, while the local roads are managed by territorial authorities. The state highways account to only 11.7% of the overall road network but they cater more than 48% of the vehicle-kilometers travelled each year. The south has achieved their goal of sealed pavement surface of all state highways with the north targeting the remaining stretches. Almost 40% of the entire road network including the local roads remains unsealed.

From the perspective of the vast density and spread of the countries' road network system, it is imperative that government agencies responsible in their respective maintenance have a proper management system of assets. Their relative experience and knowledge in this field has advanced them to the levels of standards unmatched by any other developed nations. Austroads is an agency formed to provide the research and development of asset management for responsible government agencies in both countries.

Being the leader in the management of physical assets, Australia has achieved tremendous advancement and pace in its strive towards management excellence. Through Austroads, they have researched and developed best practice approaches and processes in unifying the various agencies responsible for their management of assets. It directs them towards an integrated approach, not only for those in Australia, but also considering New Zealand as a partner.

Austroads has come a long way in generating asset management best practice, improving and upgrading processes over time, and assisted council members from the various agencies to have a generic asset management process. Their specific and strategic approaches have benefited the agencies through the issuance of guidelines and manuals. Part of its objective also includes facilitating collaboration between other agencies and promoting harmonisation, consistency and uniformity in road and its related operations. With Australia's achievement thus far, it has international recognition and involvement, as well as close rapport with similar organisations worldwide, in sharing knowledge, research and development in the Asset Management best practice.

HIGHWAY ASSET MANAGEMENT IN U.K.

This chapter will present the UK approach to highways management, in particular to England's main highways and trunk roads, which is the responsibility of the Highways Agency. It will identify the Government's specific and strategic approach towards an integrated transportation system incorporating road, rail, air and water. This relates to how the Highway Agency manages its highway assets to meet the challenges of the Department for Transport (DfT)'s Transport 2010: 10-Year Plan.

DfT handles all affairs relating to air, road, rail and water transportation modes, with relevant agencies nominated to specifically run each aspect of transport infrastructure facilities. In the road sector, the

registered vehicle population was about 32.9 million with 80 per cent under private car ownership (UK National Statistics 2005). The UK road network are categorised into motorways (M-class), primary routes (A-class) and non-primary routes (A and B-classes). The total length of roads in Great Britain alone in 2003 was 392,321 km, of which motorways accounted for 3,476 km and trunk roads for 9,340 km (Office of National Statistics, UK 2005 Official Yearbook of the UK, TSO).

The UK's approach is unique as it strategically aims to have an integrated approach in transportation, where the Government envisage all modes of transportation to be inter-connected, in its drive to serve better their customers, i.e. customer-based orientation. It aims to deliver safer, faster, more punctual and environmentally-friendly transport system for all users. This comes down through the Government's strategy to modernize the transport network, as specified in its Transport 2010: the 10-Year Plan.

In support to this strategic aim, the Highways Agency has worked closely with the Department of Transport in realizing the Government's new vision for an modern integrated transport system, from the perspective of its responsible highways and trunk roads. The HA conducted further research and developed its management of assets through various Strategic Plans, in gearing towards the Transport 2010 vision. It initially produced its own Strategic aims and objectives, and introduced improved asset management processes in managing its highways and trunk roads.

The HA looked into how these assets can be operated and maintained in line with the Government's objectives for safer, reliable travel of road users. The HA realized the need for best practice approach to its management processes. Thus, it presented the Route Management Strategy which is a technique to provide a framework for managing individual trunk routes as part of wider transport networks. It also improved its procurement approach in ensuring minimized whole-life cycle costs and optimizing its asset condition.

The Highways Agency has conducted advanced research and development into the asset management process, and is still reviewing and updating to enhance further its goals to achieve the Government's strategic aim in its modern Transport 2010.

HIGHWAY ASSET MANAGEMENT IN U.S.

The United States has a huge asset inventory of 6.4 million km of roads and 500,000 bridges worth a staggering US$ One Trillion. With almost 300 million people and large area covering 50 states, the US has achieved its earlier aim to provide a network of highways connecting all the states. It had realised the need to properly manage the vast assets with limited resources, in operating and maintaining them, towards a business style approach. It emphasised the shift in focus towards Asset Management and being responsible by reporting to shareholders, funding authority and the road users. Since the 1990s, the Department of Transport, the Federal Highways Agency and AASHTO have been working closely on the new Asset Management approach, even setting up the Office of Asset Management in 1998 under the FHWA. This serious shift in focus has led the Government organisations to introduce the Asset Management Primer document in directing other agencies in the asset management concept.

In the concept's research and development stage, AASHTO led the Asset Management Task Force to develop and implement the Transportation Asset Management Strategic Plan. From this, the Transportation Asset Management Guide (2002) was released to assist and direct the concept's application in the operation of state agencies in managing their assets. The US Asset Management approach has developed rapidly, and which is identified as very similar to the Australian's Asset Management concept. It underlines a comprehensive format, and framework, for sustainable operation and management of assets. This ensures safety, reliability, convenience and efficiency to customers.

R.A.M.S. FRAMEWORK MODEL FOR BRUNEI DARUSSALAM

The framework is generally the next step in the approach towards Asset Management. It contains all the relevant processes that will assist the management cycle. This model framework for Brunei

Darussalam will be based on the comparison of those developed by the Australians, UK and US. The proposed framework model for Brunei Darussalam will import certain aspects from those applied by the respective agencies in the developed countries, emphasising on quality data and information, and quality report and documentation. The framework will consist of the following strategic components, as indicated in Figure 2 below.

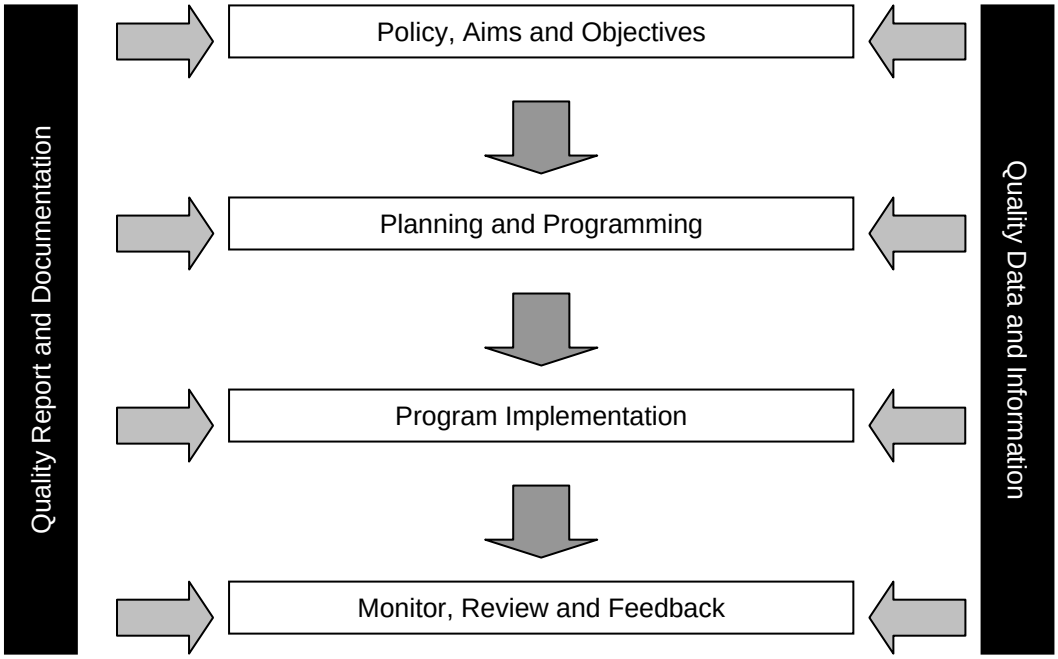

Figure 2: RAMS Brunei Darussalam Framework

Policy, Aims and Objectives

Setting the Department's strategic policy, aims and objectives will be the main driver in the Asset Management process. This component's key role is to establish a clear direction in aligning the other functions or components in the framework, which are expressed in the following criteria:

- Prime Minister (His Majesty)'s National Vision in relation to Quality of Life of the People, and related socio-economic development.
- Government's statute, regulation, policies, legislation, statements, guidelines.
- Specific directives issued from the management within the Department and Ministry.
- Mutual understanding and agreement with other parties that benefit the purpose.
- Specific requirements and expectations from stakeholders, users, communities in service delivery targets.

The Asset Management approach is used to improve the ways in which policies are conceived and formulated, where the link to performance is the foundation of the entire process. Such policies will provide the guidance on investment priorities and performance levels, and their evaluation will be based on the funding required to achieve the targeted performance levels. The policies will be subjected to revision in accordance to needs, to suit current and future legislation. The Department will need to coordinate with other policy-makers and stakeholders, as well as its internal management and staff, to be actively involved in the policy development process, thus providing broader range of solutions to issues.

Planning and Programming

This strategic component involves two aspects which include the planning and programming of works to be implemented. As in the Australian approach, it requires three phases in which the Department's strategic preparation will include the following processes, in addition to other project evaluation processes as that developed and applied in the UK context.

Asset Strategies

Firstly, the Department will identify the Road Use Strategy which contains the framework used to achieve the organisational requirements and the focus on the Key Result Areas (KRA). The KRAs are the outcomes of community consultation process which are integrated into the Department's objectives. The issues relating to road safety, traffic management, road maintenance, demand, congestion, other users (cyclists, pedestrians) needs, transport equity, heritage preservation, and regional and metropolitan road developments, should be addressed. Then, the preparation of the Infrastructure Strategy is to outline how the Department is to manage its assets in its target to achieve the requirements identified in the Road Use Strategy, in the form of on-going and continual process.

Lastly, Asset Plans are produced to summarise the Infrastructure Strategy and associated asset-specific strategies in the form of single sets or a hierarchy of plans. This is similar to the UK approach where the Highways Agency uses the Route Management Strategy in the form of a plan to achieve the desired targets along specific routes. These plans will present the current performance which will be compared to the target asset performance in identifying performance gaps to be addressed in the Program Implementation.

Asset Performance

A framework to indicate Level of Service is initially prepared to describe the service quality of an asset (travel convenience and safety performance) which depends on the asset's demand and priority. Then the Road Asset Hierarchy is developed to define the class of asset based on route functions. A Target Road Asset Performance Standards will then present the condition and configuration requirements for each Level of Service. It will also provide the required capital investments and upgrading of existing assets. The Performance Gap Analysis will be used to determine the required class of Service Level, the required condition and configuration against the existing, and to compare the actual road condition and configuration with the requirements to identify the gaps. Finally, the views obtained from community consultations in identifying asset requirements will benefit the Department's Asset Management system.

Works Program

This will outline the Total Needs Program in the form of intervention options (rehabilitation, reconstruction, capital creation, preventive and periodic maintenance) in closing the asset performance gaps. Due to resource constraints (funding), the Department will need to exercise prioritisation to ensure equitable allocation of resources, and the selection of optimum options in minimising life cycle costs. To further enhance the prioritisation process, the management can apply Value Management and Value Engineering applications to assist the selection of the most optimal options. The funding scenarios should be generated in reflecting possible funding levels, and the Works Program will finalise the options with details works required and their indicative funding.

Program Implementation

The Department will have to devise a more strategic approach towards the implementation or delivery of the programs. The key challenges include:

- Meeting customer expectations
- Maximising efficiency and effectiveness of the Department's resources through resource management
- Adhering to project scope, program scheduling and budget
- Managing associated project risks
- Managing essential changes in projects and programs as necessary

The Department's current delivery of projects are generally through the traditional form of contracting (BOQ) where projects are mainly designed and supervised in-house, except those under consultant-based project management. With the limited technical personnel to manage the large number of projects, the Department, through the Asset Management approach will need to apply other forms of procurement methods, which may include the following:

- **Innovative Contracting**: application of design-build contracts, combining capital or maintenance works (corridor approaches) and customised contracts.
- **Performance-Based Bidding**: use of performance specifications rather than traditional prescriptive for innovative solutions; best-value bidding; cost plus time bidding; life-cycle cost bidding; warranty periods for performance guarantee; incentive contract clauses in terms of monetary awards.
- **Inter-Governmental Agreements**: trading of services between agencies to benefit projects resulting in cost savings, increased efficiency, ease of access and opportunities for other alternative projects.
- **Outsourcing**: Use of integrated maintenance management contracts.

Monitor, Review and Feedback

This is an important aspect of the RAMS framework where the outputs of the process are measured against the initial objectives of the Department, using performance indicators. The monitoring of the asset infrastructure provides information on how it is performing, compares performance results and provide feedback to the stages of resource allocation and utilisation. These will be applied in identifying any necessary adjustments and review to policy, objectives, procedures and criteria for future management cycles.

Performance indicators used in system monitoring are measurable and observable, and the preferred approach should be both quantifiable and qualitative. Feedback information from stakeholders and the customers are also an essential source to performance measure of outputs of the Department in their strive towards achieving the intended service delivery. This is a method to improve the management cycle for more effective and efficient output.

Quality Data and Information

A sound Asset Management system requires objective, high-quality data and information that will be used to present to decision-makers, stakeholders and customers. Information Management is the key to the process of gathering, processing, analysing, storing, retrieving and communicating the loads of data collected. The presentation through reports and other documents should be transparent, understandable and useful, to ensure effective decision-making processes. The use of Information Technology (IT) is the most essential and effective tool in supporting the Road Asset Management System.

Information Technology

The Department has procured a software-based system for pavement physical condition in the form of the Brunei Pavement Management System (BPMS), in the last few years. It has been recently upgraded but the issue pertaining to its usefulness is the inadequate application and practice of the system by the management. This considered as a “white elephant” project needs to be emphasised and enforced to its intended purpose.

The existing Bridge Maintenance Management System is a very simple set-up designed in-house by the Department, mainly for structural bridge asset inventory and monitoring purposes. It lacks the software-based support in which this can be developed to enhance the existing system to compliment the Asset Management approach. The development will include aspects of advanced structural integrity tests and monitoring, maintenance repair programs and whole-life cycle costings.

Another relatively weak aspect of the Department’s management tools is the current road inventory database. There is yet the need to have a complete inventory database in identifying the overall road assets. The current system only stores as-built information from previous projects which are not to harmonised standards. Thus the author strongly feels the essential need to organise this very basic structure for an effective Asset Management system. A procurement method can be suggested for its development. The BPMS do have a structured inventory database but is limited to only the roads in its contract list. The Department has to undertake a project to complete the overall network to ensure harmonisation of asset standards.

The existing Traffic Light Management System in the form of SCATS is limited to several critical urban junctions in the first phase of this new system. However, more needs to be included and the system be further developed for better strategic management within the RAMS.

In the build-up to the Road Asset Management System for the Department, the author suggests that more software-based support systems be procured and incorporated. These will include new systems as well as improvements and upgrades of existing systems, as follows:

- **Asset Inventory Database System:**
  To be developed further as a software-based support system covering the entire road network of the country.
- **Brunei Pavement Management System:**
  To be improved and developed to cover the entire road network of the country.
- **Bridge Maintenance Management System:**
  To be developed further as a software-based support system covering the entire road network of the country.
- **Traffic Light Management System:**
  To be improved and upgraded to include more junction areas, with additional live-feed (real-time) video coverage through optic-fibre wired system. This system will also incorporate the management of electronic information road-signs.
- **Safety Management System:**
  A new software-based system that will cover road asset safety furniture and related road safety issues which include, asset inventory and management (creation, maintenance, replacement, renewal, disposal) of signages, lane markings, guardrails, street-lighting, speed humps, cat-eyes, etc. Other aspects include safety and traffic management of construction and maintenance works and activities.
- **Financial Management System:**
  This will be a new software-based system where the management of the Department's financial resources in terms of budget funds, allocation and expenditures, are automatically monitored and managed. This system will also incorporate the management of material costing based on market fluctuations for estimation purposes.

Data Integration

Data integration will be treated as another essential process to allow the quality data collected and managed from the IT management systems, to be shared from a single source among multiple applications, or to merge data from multiple sources for use in a single application. This is to benefit:

- Thorough information yielding a more accurate picture of what is being managed.
- Assist in coordinating management functions.
- Standardize data definitions, measurement techniques and units.
- Reduce data duplication costs.
- Ensure systems and results are consistent.

Quality Report and Documentation

As in any other organisation, the Department of Roads (DOR) has the standard obligation to present their activities through reports. These are essentially important in justifying its decisions, actions and work progress in implementing its plans and programs to meet strategic aims and objectives in the service delivery to customers and stakeholders. Reports should be quality-based and references made to specific data and information, as the required support for the actions. Reports are also a form of document used for reference purposes.

Reports

Reports are generally presented to stakeholders and also to customers as a reference point to the Department's plans and achievements, in line with expected service delivery. Existing reports that are normally produced by the Department include the following:

- **DOR Business Plan:**
  A standard annual submission to stakeholders to provide information on business intent of the Department in the forthcoming fiscal year.
- **DOR Annual Report:**
  A standard annual report to inform stakeholders on its achievements, as part of performance measure, based on its Business Plan.

In view of the Asset Management approach, it is recommended that the following strategic plans be part of its standard Quality Reports:

- **DOR Strategic Road Asset Management Plan:**
  In the event of a full-scale development of the Department's intent to convert from the traditional form of management to the Asset Management approach, this report should be produced as a basis of information and reference point for stakeholders and customers, indicating the Department's drive for modern era management, in its strategic approach towards service delivery.
- **DOR Strategic National Development Plan (5-Years):**
  This Plan should cover the Department's strategic National Development plans in proposing asset creation and maintenance projects in support of its strategic aims and objectives to be accomplished within the forthcoming 5-years period.
- **DOR Strategic Departmental Plan (3-Years):**
  This Plan is to cover the Department's proposed program to deliver specific projects, on an annual-submission basis, for expected works that cover a three year period, from planning, design, construction to completion and initial operation.
- **DOR Strategic Annual Business Plan:**
  This is an upgrade from the existing DOR Business Plan in creating and producing a more strategic approach in line with the Asset Management concept, which covers both the National Development and Departmental Plans on an annual basis.
- **DOR Strategic Annual Business Reports:**
  This will also be an upgrade from the existing DOR Annual Report, to create and produce strategic annual reporting of its Business progress and achievements in the previous year for both the National Development and Departmental Plans.

Documentations

Quality documents are strategically required to ensure that quality data, information and procedures produced and arranged, are well kept for proper cataloging, record and reference purposes. These documents generally include guides, manuals, technical specifications, standards, plans, reports, contracts, drawings and project files.

Change Management

Change is a good practice provided it is for the better, to those affected. To propose and create the change requires dedication, authority, commitment, awareness, understanding, but most importantly, acceptance to the change in the mindset. To manage and implement the change is the most challenging as it involves the actual transformation in work practices. However, this could easily be achievable so long as the requirement for change is readily accepted by the majority. There is also the need to have full support from the top management in order to ensure its effectiveness.

In this model, the author proposes that the change management should be more effective from the top-down process. It is imperative that the top management (the Director General of PWD and the Director of Roads) be aware of why and how Asset Management approach can effectively improve management processes. It is most important that there is the need to view the physical assets as "assets" and not just "roads". Hence, the traditional approach to "road maintenance" should be viewed as "Asset Management". This form of awareness, and thus the "change in mindset", could be delivered through an awareness presentation, highlighting the approach to Asset Management, as what and how the researched countries have developed to their own highway assets. This introduction can be further spread through more presentations and workshops for middle management and engineers, with the support of the top management. The whole idea is to ensure the effective response of those involved, and the keen acceptance into the Asset Management approach.

This change management should be implemented by a “soft approach”, so as not to stir fear or negative feedback by them.

However, noting that the Asset Management strategic approach is generally the directive of the government (relevant Department), which in this case, is the Ministry of Development, the author prefers that the change management be handled on a low-profile level first. That is, to start off with the Department of Roads, with the support and consensus of the Director General of the Public Works Department. This bottom-up approach is best suited to set up an integrated Road Asset Management System within the Department of Roads, and thus set an example for others to follow suit.

In the case of Brunei Darussalam, note that the overall road network of the country is only a handful (2,570 lane km of roads and 690 structures), when compared to developed countries (Australia, UK and US) in the research. It is relevant and logical that the Asset Management model is initially developed in a “straight-forward” but effective approach, rather than introducing a complex framework, and too comprehensively. This might be a “put-off” to most considering the drastic consequences in the sudden change. Here, the author again reiterates the need to conduct the change management in a soft manner, and slowly but surely, to be developed further as time progresses.

As the network is comparatively small, the Asset Management will cover all forms of road assets. These include pavements (highways, main roads, distributor, access), structures and furnitures as being an integrated Road Asset Management System (RAMS), rather than just Highway Asset Management System. That explains the dissertation title, and this is also due to the fact that road users, which imperatively means the population itself, is only close to 360,000. Thus, another reason to why the Asset Management System should be as simple and straight-forward as possible, and also considering that the resources (technical and managerial personnel) to handle the road network is also a handful.

The Road Asset Management System for Brunei Darussalam will make full use of available resources, existing management support tools and processes, and re-organise them to suit the Asset Management concept. New processes and tools are also needed to reinforce the system. This will assist top management in presenting information on project needs, status and progresses to stakeholders, customers and above all to the budget committee (fund provider). Once the awareness and change in mindset is achieved, the next step is to re-organise, and implement the change. The above is what and how the proposed model for Road Asset Management System will be derived, what existing processes and tools need to be emphasised and improved, and what new ones that need to be applied and procured.

CONCLUSIONS

The Road Asset Management System model proposed for the Department of Roads, PWD, Brunei Darussalam presents a unique approach to the current practice, in particular to how the system adopts existing management methods, tools and techniques used by the Department, re-organising and enhancing them to suit the Total Asset Management approach, with the inclusion of further new components to enhance the Asset Management framework.

In proposing the framework, and by studying those that have been developed and applied by highway asset management agencies in Australia, UK and US, the author devised the Brunei Darussalam’s version closest to that used by AASHTO’s in its Transportation Management Guide (2002). This framework is also very similar to that of the Austroads’s (Australian) approach, and includes abstracts of the methods, tools and techniques derived from all three responsible agencies in Australia, UK and US.

The proposed framework model is designed and planned to ensure an acceptable modern management system to suit the Brunei Darussalam’s context, and that it presents a “soft approach” to change management that will be introduced to the Department. It is also meant to improve and enhance current practice by providing a “best-practice” and “best-value” approaches to road asset management in the country.

The challenge now is to attract the management towards shifting its mindset from "traditional" management to "modern" as what Asset Management is. In this model, the author proposes that the change management should be more effective from the top-down process. It is imperative that the top management is aware of this modern approach and understand the need to improve current practice. It is most important that there is the need to view the physical assets as "assets" and not just "roads".

Hence, the traditional approach to "road maintenance" should be viewed as "Asset Management". This could be delivered through an awareness presentation, highlighting the approach to Asset Management, as what and how the researched countries have developed to their own highway assets. Further presentations and workshops for middle management and engineers with the support of the top management will also be necessary to encourage the change. Once the awareness and change in mindset is achieved, the next step is to re-organise, and implement the change.

The research had provided a successful outcome in the author's objective to achieve the framework model for the Road Asset Management System for Brunei Darussalam, hence the best-practice approach. This valuable outcome results in a positive approach for an internationally recognised modern management standard which will be applied to Brunei Darussalam's future management trend, thus a new beginning.

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